2019

Evaluation of Lactation Demands on Nutrient Balance in Two Calving Seasons in Range Cows Grazing Sandhills Upland Range

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Summary with Implications

A modeling study evaluated the effects of milk production level on nutrient balance in March- and May-calving cows grazing Sandhills upland range during the breeding season. Forage quality of upland range peaks in June and steadily declines in July until November. In March-calving cows, metabolizable protein (MP) and energy were deficient by July 1 in all milking potential cows, which is exacerbated in greater milking potential cows. May-calving cows with 20 to 30 lbs of milk are predicted to enter the breeding season with a deficiency in MP and energy. In an effort to match cow type to environment in the Sandhills, producers should be selecting against high milk potential. With timing of forage quality decline and the start of breeding season in July, selecting for moderation in milk production becomes even more important in May-calving herds. Supplementation to meet MP deficiency with high ruminally undegradable protein supplements may be need in later breeding cows and younger cows in both March- and May-herds.

Introduction

Selection for growth- oriented traits has been a focus in the beef industry in effort to maximize output. In doing so, cow-calf producers have tended to select for short-term traits such as growth and milk yield to increase weaning weights of calves for the potential to increase profitability. However, the economic value of reproduction is reported to be 5 times greater than growth or milk traits in beef cattle. Matching cow type or genetic potential to the production environment is and will be more important as cost of production increases. The continual increase in selection for milk production has resulted in range beef cows that are under greater nutritional stress in critical physiological periods, such as early lactation, that may ultimately reduce reproduction. Even in high feed quality environments, reproduction can be decreased in mature beef cows when peak milk production is greater than 20 lb per day. In addition, when selection of production traits exceed the capacity of the production environment, production efficiency decreases. With that in mind, increasing efficiency of livestock grazing range or pasture settings has to be focused on managing and selecting animals that fit their given environment and management. Therefore, the objectives of this study were to demonstrate nutrient balance of lactation in both March- and May-calving cows grazing Sandhills upland range with 20 to 30 lb of milk potential at peak lactation.

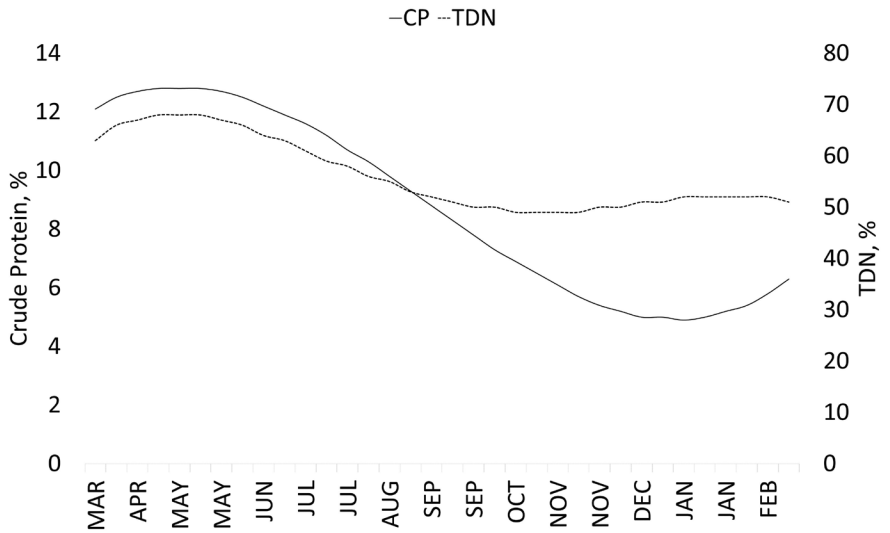

Figure 1. Laboratory analysis of range diet samples collected at Gudmundsen Sandhills Laboratory (Adapted from 1997 Nebraska Beef Report, pp 3–5).

Procedure

Native range diets for this model were collected using esophageally-fistulated cows at the University of Nebraska's Gudmundsen Sandhills Laboratory (*1997 Nebraska Beef Cattle Report*, pp. 3–5). Samples were freeze-dried, ground, and analyzed for CP, in vitro dry matter digestibility, NDF, and ADF. Using the NRC model (NRC, 2010), net energy for maintenance, rumen degradable protein (RDP), and metabolizable protein balances were predicted for a March- and May-calving cow grazing Sandhills upland range during the breeding season. The nutrient values in the diet samples used in these analyses and the intake values used differ from those in another report (*2019 Nebraska Beef Cattle Report*, pp. 50–52). The primary differences are in diet TDN contents and estimated intake. These 2 factors tend to compensate across the 2 reports and estimate similar intakes of energy and protein.

Assumptions for the model were:

1. Cow body weight = 1200 lb
2. Body condition score = 5.0
3. Cow age = 48 months
4. Peak milk production = 20, 22, 24, 26, 28, or 30 lb
5. Estimates of dry matter intake were based on NRC model estimations
6. No additional supplementation was included in any calculation

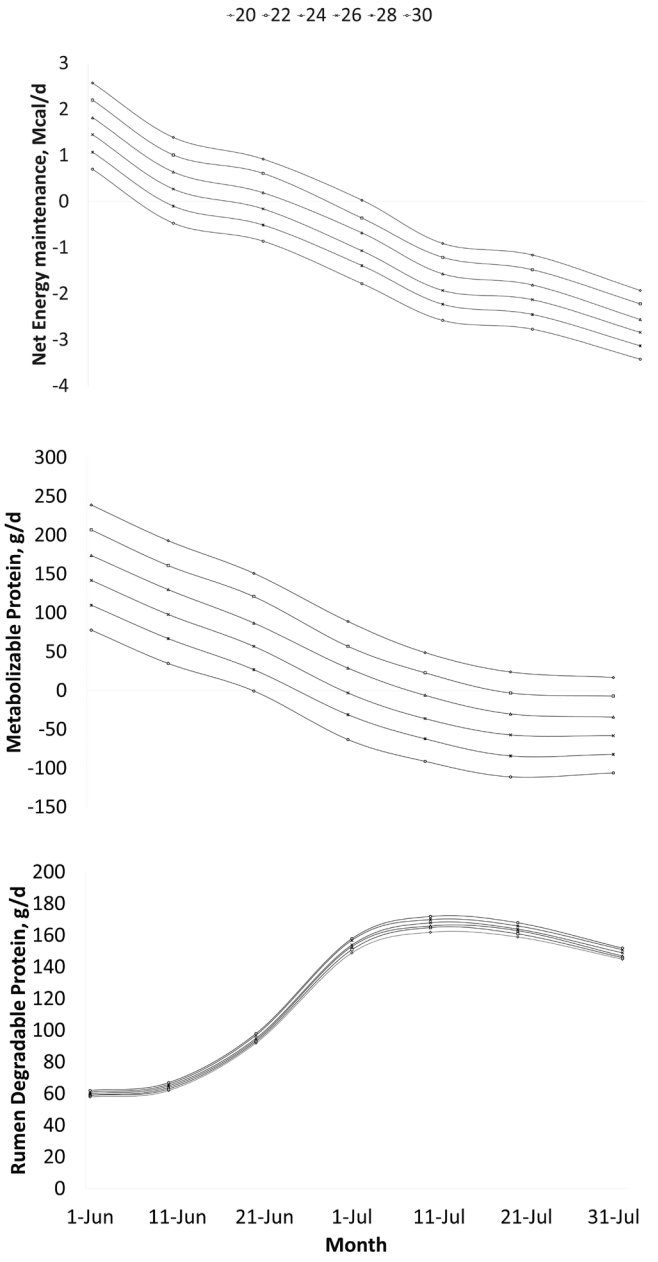

Figure 2. Evaluation of NEm (top graph), metabolizable protein (middle graph), and rumen degradable protein (bottom graph) balances for March-calving cow with milk production ranging from 20 to 30 lb of milk at peak lactation while grazing Sandhills upland range with a June 1st start of breeding date.

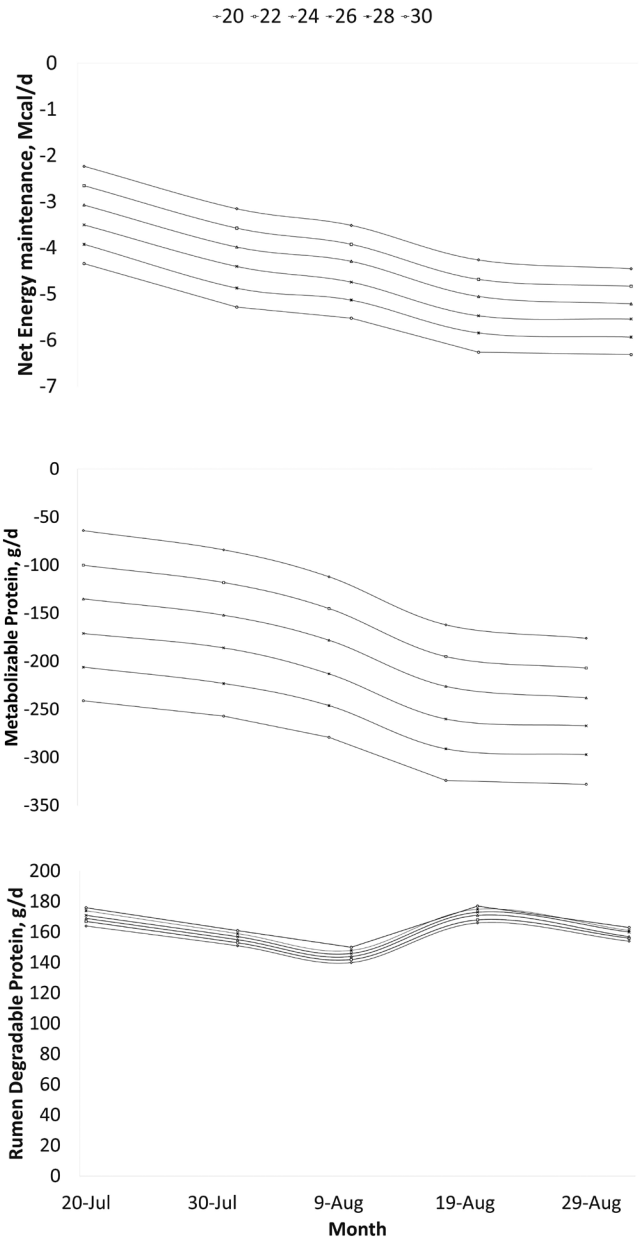

Figure 3. Evaluation of NEm (top graph), metabolizable protein (middle graph), and rumen degradable protein (bottom graph) balances for May-calving cow with milk production ranging from 20 to 30 lb of milk at peak lactation while grazing Sandhills upland range with a July 20th start of breeding date.

7. Breeding season started on June 1 for March-calving herd and July 20th for May-calving herd.

Results

Profit-motivated cow/calf operations must become more cost efficient to offset this increase in production costs. This increases the need for producers to match cow size and milk production potential to forage resources in order to optimize forage utilization and reproductive efficiency. Matching nutrient availability of range with nutrient requirements of the cow has been recommended to efficiently utilize forage quality. In doing so, changing calving date has been utilized to match nutrient requirement of genetic potential for milk production with the greatest nutrient value of the forage. Figure 1 illustrates the seasonal changes in crude protein and digestibility for esophageal diet samples collected from upland native range pastures at Gudmundsen Sandhills Laboratory. Peak CP and digestibility occurs in June, which occurs

with the onset of the breeding season for a March-calving herd. As the season progresses, CP and digestibility decline until November.

March-calving Results

At the start of breeding in the March-calving herd, cows across all milking potential levels are predicted to be in a positive energy, MP and RDP balances. For all milk production levels, RDP was predicted to be in excess of requirements with RDP balance plateauing in the second week of July. As the breeding season progressing in June and July, both with energy (NEm) and MP balances are linearly decreasing across milking levels. Cows milking in excess of 28 lb of milk at peak lactation are in a negative energy balance by June 11th. By July 1st, all cows are predicted to be in a negative energy balance. With negative energy balance projected to occur within the first 30 days of the breeding season, reproductive performance may decline in cows that did not conceive early in the breeding season. Similar to NEm by July 1st, cows milking 26 lb or more at peak lactation would be in a deficit MP balance. By the end of breeding, only cows milking 20 lb of milk at peak were in a positive MP balance.

May-calving Results

Similar to March-calving herds, RDP balance was in excess and was predicted to be from 140 to 180 g/d above requirements during the entire breeding season. However, both NEm and MP balances were in a deficit at the start of breeding. Coming into the breeding season in a negative energy balance creates a scenario that cows have to have the ability to mobilize and utilize stored body fat effectively to reproduce. The energy and MP deficient puts more stress on younger, lactating cows. Young cows that are still growing and lactating with their first or second calf may drop out of the herd sooner in a May season due to decreased energy intake and reduced pregnancy rates. For instance, previous research has illustrated that pregnancy rates in mature cows from March or May-calving herd are similar (*2001 Nebraska Beef Cattle Report*, pp 8–9); however, pregnancy rates in May-calving heifers are decreased compared to March-calving heifers (*2017 Nebraska Beef Cattle Report*, pp 8–10). This may be partially due to an imbalance of milk production and environmental condition.

Conclusion

In general using the UNL diet model, the NRC predicted that a lactating March- and May-calving cow would not be deficient in RDP during the entire breeding season. In March-calving herds, the deficiency in MP and NEm occurred after 30 days of breeding when milk production was above 24 lb per day, which may create a situation that if cows don't get bred early then reproductive performance may decline as the breeding season progresses. In May-calving herds, lactating cows were deficient in MP and NEm during the breeding season. Summer calving cows With RDP requirements in surplus during the breeding season and as milk potential increases, there is a greater demand to supply supplementation that would meet the energy and MP deficit. Supplementation with a high RUP supplement with added energy such as distillers grains may still be needed in young cows to meet the deficiency in MP. Supplements high in RDP will likely not correct the MP and energy deficiencies. In addition, complementary forage systems (i.e., regrowth sub-irrigated meadow) may be utilized to increase performance in young range cows.

Moving cows from a spring-calving herd to a summer-calving herd matches calving date with increased quality forage to reduce feed costs compared to spring calving herds (*2001 Nebraska Beef Cattle Report*, pp. 8–9). However, due to the sharp decline in nutrient requirement at peak lactation (approximately 60 days postpartum) and during the breeding season, milk potential of the cowherd may have to decline as well to match the environment as shown with the greater nutritional deficit during breeding from 20 to 30 lbs of milk. In addition, drought conditions could exacerbate the deficiency in MP and energy in greater milk producing cows if forage conditions decline. Although, moving calving to a May-calving season may decrease winter feed cost, due to the forage quality during breeding, supplemental inputs during the breeding season may be greater in May-calving herds, especially in young range cows, to optimize pregnancy rates.

With current trends of selecting for increased output- oriented traits in purebred and commercial herds in the US, average milk production at peak lactation has increased in the mid to high 20 lb. The continual increase in selection for milk production in beef cows increases the nutritional stress in critical physiological periods, such as early lactation, and will ultimately reduce reproductive traits and/or increase production costs to maintain performance. This modeled dataset illustrates the need for future research focused on cow type (i.e. genetic potential for milk production) within timing of calving to optimize cow herd production in the Nebraska Sandhills.

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